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VARIETAL STANDARDIZATION OF SORGO AND THE SELECTION OF SEED¹

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INTRODUCTION

The group name, sorgo, is applied to those sorghum varieties that have abundant sweet juice, to distinguish them from kafirs, milos, and other grain sorghums, also from Johnson grass and Sudan grass. These grain sorghums, as well as Johnson and Sudan grass, being in a broad botanical sense "sorghums," are similar to sorgo in floral structure and more or less in general appearance. They have little or no expressible juice, however, and are not rich in sugars.

Sorgo is cultivated both for the manufacture of sirup and for forage in greater or less extent in 35 or 40 States, including some with as diverse climatic conditions as Minnesota, Virginia, Utah, and Arizona. At present about twenty-five to thirty million gallons of sirup are made annually from sorgo, the bulk of this being produced in the Southern States. The use of sorgo for forage is rather extensive. Because of this wide utilization of sorgo, a number of local names for the varieties have developed and considerable confusion exists as to these varieties. This circular has been prepared to give descriptions of the leading sorgo varieties and to aid growers and seedsmen in procuring sorgo seed true to name.

STANDARDIZATION OF VARIETAL NAMES

Notwithstanding the fact that seed of sorgo is utilized by growers and handled by seedsmen in nearly all sections of this country, names of the varieties, except in two or three instances, have not been established, and the characters which distinguish the varieties are in general not known. Varietal names are frequently much confused, and when growers attempt to obtain seed of any kind or kinds with which they have become familiar or that have been reported to them

¹ This circular is the second publication in a series on sorgo for sirup production, the first being Department Bulletin No. 1386, a technical bulletin which reports an investigation of the distinguishing characters found in the panicle, or head. Additional publications are in preparation dealing with the culture, handling, and varietal improvement, as well as giving the results of agronomic tests with commercial varieties.

as having superior qualities they are very often unable to do so. If the seed in question is handled at all by the dealer, it is under a name different from that by which the grower has either known or heard of it. A few types are recognized in some localities, but these in many cases represent groups of varieties rather than individual sorts. This confusion regarding varietal names often is due to the fact that the sorgo seed which is sold by the dealer is purchased by him in other localities, through the agency of other dealers. The seed may then be sold in a locality far from where it was grown.

In this case the dealer from whom the grower purchases his seed does not see the standing crop, and rarely does he see the seed in the head. Furthermore, the small size of the seed, as compared with cotton, corn, or cowpea seed, and the fact that the seed characters in only a few varieties are distinctive enough to permit easy identification have made it extremely difficult to prevent mixing, substitution, and general deterioration of seed stocks.

The entire panicle, or head, is usually necessary for the sure identification of the variety, and it is much better to make determinations from an entire field of mature plants. Seed is never, or rarely, sold commercially in the unthreshed condition. The purchaser must depend, therefore, mainly on statements made by the dealer, not only in regard to the varietal name but also as to the type of the head, the seed characters, and its purity. The grower of the seed is not usually able to furnish very definitely this information, (1) because there is such confusion in varietal nomenclature that a variety is sometimes known by a different name in each locality where it is grown; and (2) because ordinarily neither the grower nor the dealer is familiar enough with the parts or members of the head and spikelets and the names of these parts to furnish a satisfactory description. For these reasons, when a grower purchases seed for planting he usually can not be sure that he is obtaining the variety he wishes to grow.

To remedy this confusion regarding varietal names, the writer, as a result of several years of study of many varieties under field conditions, taking also into consideration the authentic descriptions of the varieties such as are to be found in publications on the subject and to some extent those in trade catalogues, has prepared the provisional descriptions herein given of leading varieties under the names which he believes to be the most acceptable.

The advantages which will accrue from a uniformity of trade practice in this matter of varietal names do not need enumeration. In many of the agricultural crops such standardization has already been effected and has resulted in marked benefits, making possible greater profits as well as greater security in the purchase and sale of products. It is not too much to expect that similar results will come from the standardization of the names of sorgo varieties. Varieties show pronounced differences in yield, composition, and other characters, and when the varietal names become standardized the growers will be able to compare results in a way not now possible.

Progress in this regard will doubtless take considerable time because of the wide geographical distribution of sorgo growing and because the description of a variety needs to take into consideration certain small differences in the type of head and in the form, size, color, and other characters of the floral parts. The differences

which occur in the varieties when grown in different localities will also need to be studied; and it is desirable that experiment stations procure seed of these varieties and grow them in comparative plots, so that notes may be made on their taxonomic characters and these compared with the descriptions given in this circular. The writer believes that there is a growing appreciation of the value of the sorgo crop and a definite interest in steps for its improvement. These will result in more and more attention being paid to suitable, true-to-name varieties, and it is hoped that the information furnished in this and the previous publication on characters useful for identification² will be an aid to progress in the standardization of varietal names.

MEANS OF OBTAINING RELIABLE SEED

Because of the present difficulties in the way of procuring seed true to name, just outlined, it is better for the grower so far as possible to select the seed heads of the varieties he wishes to grow from plants standing in the field. In this way, seed can be obtained from plants which are true to type, and selections can also be made with a view to improving the strain. When the grower is selecting his own seed, precaution should be taken against getting seed from plants that have been pollinated by types other than the one it is desired to grow. It is possible by this practice for growers and for seedsmen to obtain seed that is of higher grade and purer and that will perpetuate itself truer to type than ordinary commercial seed. Consistent selection of seed of desirable types from fields of superior or promising varieties made at the time when the heads are about mature will furnish seed which will give far better returns than nondescript commercial seed. In such selection the grower should take into consideration not only the head characters but also the size, habit, and general vigor of the plant. This selection will not insure absolute purity of the seed in all cases, for pollen from other varieties or even from some of the grain sorghums or from Johnson grass or broomcorn may have been carried by the wind and caused contamination either in the current season or in a previous one; but if the heads are taken from the interior of the field, the possibility of contamination by undesired pollination will be slight unless the field contains a considerable admixture of other varieties.

The effect of cross-pollination is not evident in the crop of the season in which the crossing occurs. It will, however, cause a difference in the appearance of the plants of the succeeding crop, which as a result of the crossing would show a tendency to be more vigorous and would very likely show minor differences in color and in the form of the head and floral parts. When these differences which arise as a result of hybridization are known the offtypes can be avoided, and in making the selections the heads should always be carefully scrutinized so as to insure the selection of plants typical of the desired variety. As there is usually more than one point of difference in every distinct race or variety, undesired types can be discarded. As a result of following for a number of years this practice of seed selection, the variety will become essentially pure. It is ordinarily not necessary to magnify the parts of the head in order

² COWGILL, H. B. SOME PANICLE CHARACTERS OF SORGO. U. S. Dept. Agr. Bul. 1386, 37 p., illus. 1926.

to be able to discriminate between the different heads sufficiently well to make selections of this kind.

The saving of seed of superior varieties is thus the surest way of obtaining high-grade sorgo seed. Unfortunately, however, uniform fields of the best varieties are not always available for making the selections, in which case recourse must be had to neighboring fields or to fields in other localities.

For this reason, it is highly desirable that the standardization of the names of the principal varieties, at least, be established by descriptions extensive enough to permit them to be determined, so as to enable growers to procure seed with some assurance as to identity.

STRUCTURE OF THE HEAD AND SPIKELETS OF SORGO

The reader who desires to be able to distinguish sorgo varieties needs to familiarize himself with the parts of the sorgo head or panicle and of the spikelet, the latter being a part of the inflorescence or head that is inclosed by the glumes or outer chaff. In this study a few technical terms will be encountered, and definitions of these are here given. Varieties can very often be determined quite definitely without magnifying the parts of the head. This is especially the case when it is known that only certain varieties are grown in the locality. For this reason, the source and history of the variety should be learned, when this information is available. When it is desired to determine closely similar sorts, it is advantageous to have the spikelets magnified. Points of difference regarding degree of compactness of the head and its form, size, and general color are not sufficient to differentiate the varieties clearly. Differences in the spikelets are usually more reliable than those relating to form, size, degree of compactness, and general color of the head. A hand lens which will give magnifications great enough for ordinary purposes and which is suitable for use in the field can be purchased for about \$6.

Since the descriptions are based largely upon the characters of the head and of the spikelets, these will be considered fully. Figure 1 diagrammatically represents a portion of a head, and also spikelets, of a variety of the open and spreading type, the several parts of these being indicated. The structure is more easily seen in this type than in the more compact types. Varieties do not differ regarding parts of the head, but they vary in the form, size, arrangement, color, and hairiness of the parts. In other words, varieties with compact heads do not differ from those with spreading heads in essential parts. The branches of the head are shorter, more rigid, closer together, usually more erect and more hairy, and they are often more angular, but otherwise they are essentially the same. A similar statement can in general also be made in regard to the spikelets, as spikelets of all varieties possess essentially the same parts or members. As will be noted from the illustration, spikelets are of two kinds, fertile and sterile. The fertile spikelet when mature contains a grain, technically known as a caryopsis, and the sterile spikelet is easily recognized even in heads which have not yet emerged, being smaller and each commonly supported by a short pedicel or stalk which originates at a point next to the base of a fertile spikelet.

The fertile spikelet is composed of a number of parts, but the only parts which are of importance for purposes of identification are

the glumes (the outer chaff which more or less covers the grain), the awn (the stiff, twisted spine, sometimes called a beard, which is sometimes but not always present), and the grain. The other members are largely covered by the glumes and are fragile, being easily broken if the spikelet is dissected. The first glume originates a little lower than the second and is partly wrapped around it. Glumes differ mainly in form, thickness, the extent to which they open, color, venation, and hairiness; the grain in form, length as compared with the length of the glumes, and in color; and the awn in length, color, and extent of twisting. The form of the first glume generally determines the form of the spikelet.

In referring to the grain, the terms germ, radicle, plumule, endosperm, and style bases are used in the descriptions. Figure 2 is a diagrammatic drawing of a grain in which its features are designated. As the term is used here the germ of the grain is the embryo. The scutellum (*b*) forms the greater part of the embryo or germ, the radicle (*d*) and plumule (*e*) constituting the remainder. The endosperm (*c*) is that part of the grain which is not included in the embryo. The germ is usually elliptic or obovate-elliptic in form. It extends from the base of the grain upward for about one-half or three-fifths the length of the latter. Strictly speaking, the radicle is the first root which breaks through the seed coat or pericarp when germination takes place. As used here, this term indicates an elevation on the grain

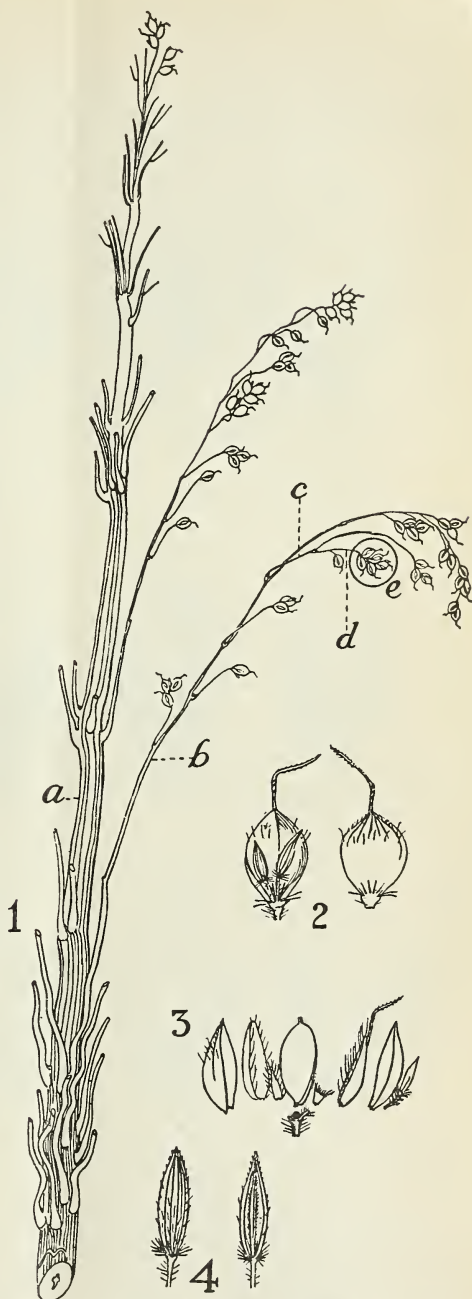


FIGURE 1.—Portion of a head and spikelets of Honey sorgo. 1, Axis of the head having most of the branches removed; 2, fertile spikelet with two sterile spikelets attached; 3, fertile spikelet dissected and sterile spikelet, showing parts of the fertile spikelet from left to right—first glume, sterile lemma, grain, lodicules, fertile lemma, and second glume; 4, sterile spikelet, showing pubescence of the pedicel and callus, the scabrous-hispid lateral nerves, and ciliate edges of the first glume

caused by the rudimentary radicle within the seed coat. It occupies the middle of the lower part of the embryo, as shown in Figure 2. In like manner, the term plumule is used to designate not the true plumule, which is the first leaf bud of the embryo, but a prominence or elevation in the seed coat caused by the plumule within. It is in the middle of the upper part of the embryo, as viewed superficially. The style bases (*f*) are two small protuberances on the summit of the grain, being the remains of the styles which in the blossom stage supported the anthers. Their exact position varies somewhat with different varieties.

The grain is considered as having a base, a summit, a front or ventral side, and a back or dorsal side. The scar (*a*), or place of attachment of the grain, is at the base, and the style bases are at the summit. The side of the grain on which the scutellum is visible is the dorsal side, and the opposite is the ventral side. Figure 2 represents both a dorsal and a lateral view of a grain. Frequently the summit of the grain is somewhat turned toward the ventral side, and the style bases then have the appearance of being not at the summit but on the ventral half of the grain.

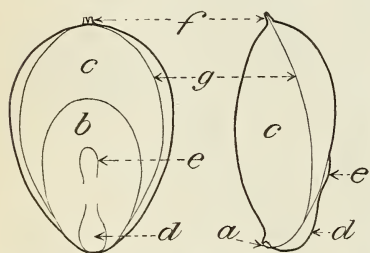


FIGURE 2.—Diagrammatic drawing of a sorgo grain, showing dorsal and lateral view: *a*, Scar, or place of attachment; *b*, scutellum; *c*, endosperm; *d*, radicle; *e*, plumule; *f*, style bases; *g*, longitudinal lines

DESCRIPTIVE TERMS DEFINED

The following additional definitions should become familiar to any one who desires to be able to recognize varieties. The peduncle is the continuation of the sorgo stalk beyond its last node or joint, which supports the head. In Figure 1 little of the peduncle is shown, for after branches of the head begin to occur the further continuation of the peduncle through the head is termed the axis of the head. Nodes of the axis are places or joints where branches of the head originate, and internodes are the portions of the axis between the nodes. Nerves, as the term is used in botanical descriptions, are fine parallel veins in the glumes, of greater or less distinctness and length. In this circular the term vein is used rather than nerve, as the term is more generally understood. When the nerves or veins are spoken of collectively, the term venation is used.

The terms ovate, elliptic, obovate, rhomboid, and suborbicular are used in describing forms of spikelets, glumes, or grains. Compound terms, such as ovate-elliptic and obovate-elliptic are also employed. Ovate, as used in a botanical sense, denotes a plane figure which is approximately egg-shaped, having the larger end at the base, and the term obovate is used to indicate a similar figure with the larger end at the summit. The meaning of the term elliptic, as commonly used, is generally understood. As used in botanical descriptions, it has a similar meaning, denoting a plane figure longer than broad, with more or less rounded outline, and having its greatest width at the middle. Deltoid signifies a figure approximately the form of the Greek letter delta, a triangular form. The term rhomboid indicates approximately the form of a rhomb, this being a 4-sided figure whose sides are equal, whose opposite sides are parallel, and none of

whose angles are right angles. Suborbicular means a nearly round plane form. When two terms are used as a compound, as, for example, ovate-elliptic or obovate-elliptic, an intermediate form is indicated. In the descriptions included in this circular, when these terms are used, unless otherwise stated, they refer to the outline of the member presented by its greatest breadth. In Figure 3, A, are represented ovate spikelets; Figure 3, B, elliptic spikelets, and Figure 3, C, both obovate and obovate-rhomboid spikelets. The summit, or the extremity of the glume farthest from the place of attachment, is described as being either acute (meaning pointed) or obtuse (meaning rounded). In referring to the summit of the grain the terms acute, obtuse, and globose are used, the latter denoting a somewhat spherical form. All these terms except the last refer to the form of the outline of the spikelet, glume, or grain, as shown by its greatest breadth.

NATURAL GROUPS OF VARIETIES

The form and arrangement of the branches of the head and the form of the spikelets are most easily seen in spreading types. When varieties having heads of these types are examined, it is seen that they also possess certain other points of similarity.

Contracted and compact types may be considered to be alterations of the spreading. Points of similarity are also to be seen in groups of varieties having these types of head. In the spreading types the branches of the head are longer, farther separated, and less rigid than in the more compact types. They often stand out from the axis at their bases, and they may be curved or bowed outward, especially near the extremities. They are usually also less hairy and less angular than in the more compact

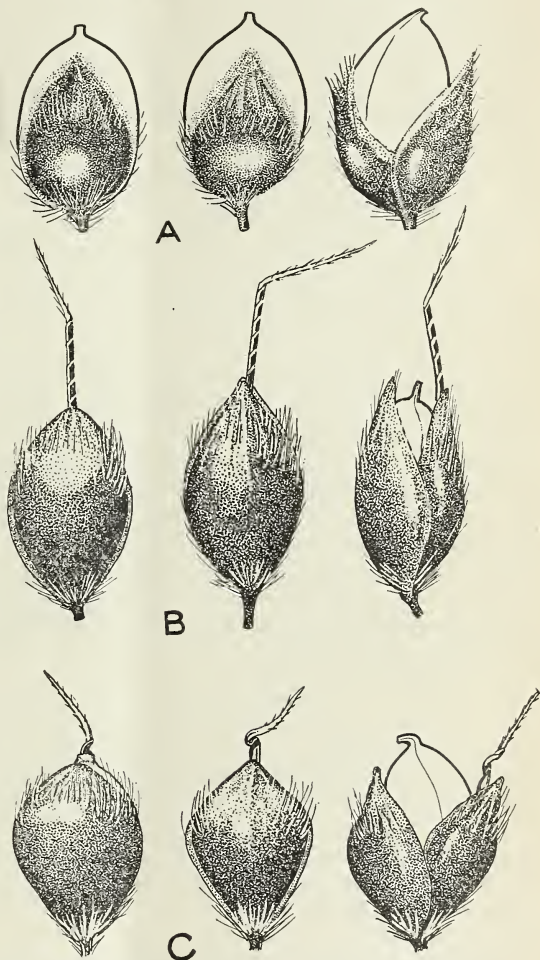


FIGURE 3.—Spikelets of distinct forms. A, Ovate; B, elliptic; C, obovate and obovate-rhomboid

types. Minor groups of varieties, or what may be known as subgroups, based on similarity, may also be recognized. These will become apparent to the reader as he studies the descriptions.

Although it is not possible to classify varieties into the principal groups in regard to the type of the head by very definite lines of separation, in a general way they may be separated by describing the spreading group as having relatively long branches of the head. At the time of maturity the larger number of these branches stand out from the axis of the head, and they are often more or less bowed. The compact group may be described as having the branches of the head mainly appressed, or at least ascending. In a semispreading group, or what may be called the intermediate or contracted group, the branches of the head are intermediate in length, and some of them usually stand out from the axis, but not a majority of them. The remainder of the branches tend to cleave to the axis. They are all usually appressed to the axis at their bases.

Differences in vigor of growth, due to differences in soil or climatic conditions, are evident in the size of the head and in the length of the axis and branches, as well as in the size of the stalks. This affects the degree of openness of the head, so that varieties the heads of which are quite open in one season or under one set of conditions sometimes have heads which are compact under other conditions. So also climatic conditions affect the form and direction assumed by the branches. Under dry conditions the branches as a rule are more appressed to the axis and straighter than under humid conditions. For these reasons the form and the degree of compactness of the head are not very good characters for identification of varieties. When seeking to determine the variety and especially to differentiate between closely similar sorts, it is better to place reliance on characters of the spikelets, as, for example, the form of the fertile spikelet, its glumes and the grain, the thickness of the glumes, and the protrusion of the grain.

DESCRIPTIONS OF VARIETIES

The descriptions of varieties which follow are presented primarily as a basis for establishing the varietal names, in order to obviate to some extent at least the confusion in varietal nomenclature which prevails. Though all the varieties described are not in common or extensive cultivation at the present time, those which are not cultivated to a considerable extent are occasionally encountered; and it will be easier for the reader to see varietal differences by considering the entire series.

It should be borne in mind that there may be varieties or strains identical or very similar to some of those herein described which are not like them in economic value. Although two sorts may have had a common origin, their values nevertheless may be quite different from the point of view of sirup production, as they may differ in the percentage of juice and in the percentage of sugar in their juices, even though the tonnage yield of stalks obtainable from them is essentially the same. Varieties are sometimes selected for improvement of sugar content without regard to taxonomic characters, and new strains obtained in this way do not always show differences in their distinguishing characters. Accidental crossing is often the cause of

deterioration in varieties, and growers making selection of seed for planting can not as a rule consider sugar content. They therefore select mainly by characters which are apparent to the eye, such as the size of the stalk and characters of the head. Nevertheless, if two sorts are identical in appearance and reach maturity in approximately the same length of time, it is well to assume that they are the same variety until they have been proved to be diverse.

The varieties which are described were obtained originally from various sources, some being procured from growers and some from seed dealers, a considerable number of lots of seed being obtained and grown in the years 1918 to 1926. It was found after they had been grown one season that in many cases these so-called varieties each contained a number of easily recognized types of sorgo, seed of some of the grain sorghums, broomcorn, and Johnson grass sometimes also having been mixed with the seed originally obtained. In the first season, and also subsequently, each was selected in accordance with a prevailing type, unless, as was true in some cases, the sort was so impure that it was impossible to do so. In some cases it required three or four years to accomplish the purifying of the variety.

It became evident after the varieties had become relatively pure that in some cases the same name had been applied to two or to a number of varieties and that in other cases the same variety had been cultivated and the seed sold under a number of names. It was necessary, therefore, to choose new names for some of the varieties. The code of nomenclature of the American Society of Agronomy³ was followed in choosing the names which would be adopted. In all cases where it was possible to do so, a name was chosen which was similar to the name or one of the names by which the variety had been previously designated.

In making the descriptions it has been the aim as far as possible to have them comparative with regard to the same features of the stalk, head, spikelets, and grain in each variety, presenting also additional distinctive characters that may be present. The characters considered are the following: Length of stalk; girth of stalk; habit of stalk; other noteworthy characters of the stalk; form of head; compactness of head; size of head; other noteworthy characters of the head; form of fertile spikelet; whether fertile spikelet is awned or awnless and special noteworthy characters of the awn, if any; thickness of glumes; color of glumes; extent and manner of opening of the glumes; venation of glumes; other noteworthy characters of the glumes; whether the grain is covered by the glumes or protruding; form of grain; color of grain; other noteworthy characters of the grain; form of germ; color of sterile spikelet; prominence of sterile spikelet; persistence of sterile spikelet; other noteworthy characters of the sterile spikelet.

Though a knowledge of differences regarding all the above-named points is not needed to discriminate between many of the varieties, the fuller the descriptions the more easily and certainly will the varieties be identified. In view of the fact that the morphological characters which differentiate varieties in this country have until recently been little studied and presented and because a number of other

³ COMMITTEE ON VARIETAL NOMENCLATURE. CODE OF NOMENCLATURE FOR THE AMERICAN SOCIETY OF AGRONOMY. Jour. Amer. Soc. Agron. 9:425-427. 1917.

varieties are more or less similar to some of these included in this circular, it seems proper to make the descriptions fairly complete and the descriptive phrases full.

Approximate measurements of the length and breadth of the head are given in the cases of a few varieties that represent extremes in size, and the sizes of the remainder are comparable with these. It should be remembered, however, that in many varieties the size of the head and the length of its branches vary greatly, owing to differences in soil or in climatic conditions in which the plant grows.

The descriptions presented in this circular, as well as those of the inbred strain included in United States Department of Agriculture Bulletin No. 1386,⁴ must be considered more or less provisional and tentative. Although all of these varieties have been studied when grown on at least two soil types in the same general locality⁵ and certain of them have been examined when grown on other types of soil in other localities, nevertheless a study of them when grown in additional environmental conditions may make it necessary to some extent to modify some of the descriptions. This applies especially to the color of the parts, particularly of the glumes and the grain. The varieties may also to some extent show variation due to causes other than environment. When a larger number of varieties are described, it may be necessary to modify or to make more specific the descriptions of some of the varieties herein listed. Furthermore, when the varieties comprising the entire sorgo group are described, it may be possible to simplify the descriptions to some extent.

In many varieties there is a wide variation in the form of the head, even on plants grown under the same conditions and in the same stage of maturity. For this reason it is sometimes difficult to indicate the types which may be represented in the variety. In these descriptions the entire range of types is not always presented. Usually the more common types are indicated, but the aberrant or exceptional types as a rule are not noted.

The colors given are intended to represent those present when the seeds are mature. The most common color, as a rule, is given first, less common shades or colors often being given subsequently. It should be borne in mind that color is not a very dependable character. Like the form and degree of compactness of the head and the length of its branches, color is apt to change with the season and with the advance of maturity. Yet the colors as presented in these descriptions should be useful as means of helping to identify the varieties.

Minnesota Amber (fig. 4).—Stalk medium or tall, slender (up to three-fourths inch at the base), erect; head conical, approaching conical, or sometimes approaching cylindric, open, 8 to 16 inches long, 5 to 9 inches broad; axis of head extending to, or nearly to, the summit; primary branches of head commonly appressed at their bases, but standing out from the axis above and sometimes bowed outward, especially near the extremities; fertile spikelet commonly elliptic, or approaching elliptic, awnless; glumes thin, soft, and pliant, at least in the upper one-third, acute or obtuse, the margins sometimes infolded at the summit, dark brown or nearly black, open 10° or as much as 45°, the second glume bent or crumpled at the base in the opening; veins fine, visible from the apex to, or nearly to, the base of the glume, the coarser vein on each side of the first glume often beset with minute bristles above; grain more commonly not extending

⁴ COWGILL, H. B. Op. cit.

⁵ The investigation of varieties upon which this circular is based was conducted mainly in the vicinity of Fort Smith, Ark.

as far as the apices of the glumes, elliptic or approaching elliptic, usually more convex on the ventral than on the dorsal side, the summit obtuse and not turned, or turned a little toward the ventral side, yellowish or brownish yellow; germ conforming to the dorsal surface of the grain, the radicle prominent; sterile spikelet yellowish, or entirely or in part blackish brown or grayish brown, occasionally prominent, the pedicel commonly becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Slender stalk; open head without awns; thin dark brown elliptic or nearly elliptic glumes, extending as far as or beyond the commonly yellowish elliptic grain.

This variety is sometimes called Black Amber, Early Amber, Early Black Amber, or Minnesota Early Amber.

Other varieties more or less different are also sometimes designated by the foregoing names, and these are sometimes intermixed with Minnesota Amber both in fields and in commercial seed. Some of these varieties are awned; in most of them the glumes are more thickened, not being soft and pliant as in this variety. One of these varieties is called Sasnac Amber. It is awned, and its glumes are thickened and black in color. Another variety called Mazo Amber is somewhat similar. It also is awned and has thickened reddish brown glumes.



FIGURE 4.—A head of Minnesota Amber sorghum. (From Minnesota Agricultural Experiment Station Bulletin 187)

Honey (figs. 1 and 5).—Stalk tall, large in girth (sometimes as much as $1\frac{1}{2}$ inches thick at the base), tapering much toward the summit, erect; head conical, open, 12 to 18 inches long, 8 to 12 inches broad; nodes of axis somewhat oblique; internodes a little curved immediately beneath the nodes; branches of head long, often curved or bowed outward; fertile spikelet obovate-elliptic or elliptic, awned, the awn medium in length and somewhat loosely twisted; glumes considerably thickened, even the apices not soft and pliant, acute or approaching acute, reddish brown or sometimes light brown, open 10°



FIGURE 5.—A head of Honey sorgo

or as much as 45° , not bent back at the base in the opening, veins not visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain commonly not extending as far as the apices of the glumes, elliptic, obovate-elliptic, or ovate-elliptic, the summit obtuse and hardly turned toward the ventral side, light reddish brown, light buff or sometimes entirely or in part dark reddish brown or yellowish; germ conforming to the dorsal surface of the grain, the radicle prominent; sterile spikelet brown, reddish brown, or entirely or in part yellowish, occasionally prominent, the pedicel commonly becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Thick stalk; open, conical head having awns; thickened reddish brown or light brown obovate-elliptic or elliptic glumes, commonly extending beyond the reddish brown or buff elliptic or nearly elliptic grain.

This variety is sometimes called Japanese Ribbon, Seeded Ribbon, Texas Seeded Ribbon, Japanese Honey Drip, or Honey Drip. At earlier periods it was called Honduras, Mastodon, and Sprangled Top.

An earlier maturing variety similar to Honey is sometimes called Red Amber. It is not the variety which immediately follows.

Red Amber.—Stalk medium in length, slender, erect; head commonly ovate or conical, sometimes somewhat one-sided, open or semicompact, medium or small; branches of head long or medium in length, straight or bowed outward; fertile spikelet commonly elliptic or approaching elliptic, awnless; glumes considerably thickened, usually acute, reddish brown or brownish red, open 10° or as much as 60° , the first glume commonly bent back at the base in the opening; veins of first glume not usually visible below the middle of the glume, the coarser vein on each side beset with minute bristles above, not visible in the second glume;

grain commonly extending to the apices of the glumes, obovate-elliptic or elliptic, the summit obtuse and turned somewhat toward the ventral side, light orange, brown, or entirely or in part reddish brown or light orange; germ conforming to the dorsal surface of the grain, the radicle commonly somewhat prominent; sterile spikelet brown, brownish red, or entirely or in part yellowish, occasionally prominent, the pedicel becoming fragile and tending to release the spikelets at about the maturity of the grain.

Chief distinguishing characters: Slender stalk; open or semicompact head without awns; thickened, commonly reddish brown, elliptic or nearly elliptic glumes, extending about as far as the usually orange brown obovate-elliptic or elliptic grain.

Collier (fig. 6).—Stalk medium in length, medium in girth, erect, branching somewhat profusely from the upper nodes; head commonly obconical or cylindrical, the summit often nodding, semicompact, about 5 to 8 inches long; axis of head having but a single node bearing branches, or several, sometimes the entire length of the head; primary branches of head often spirally twisted at the base; fertile spikelet ovate-elliptic or elliptic, awnless; glumes considerably thickened, commonly acute, the margins sometimes infolded at the apices, entirely or in part light yellow, brownish, grayish, or nearly black, often somewhat mottled or spotted, open 20° or as much as 60° , the first glume often bent back at the base



FIGURE 6.—Two heads of Collier sorgho

in the opening; veins commonly visible from the apex to below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain usually not extending to the apices of the glumes, elliptic-obovate or elliptic, the summit obtuse and turned somewhat toward the ventral side, medium reddish brown or entirely or in part dark reddish brown or yellowish; germ curved somewhat toward the ventral side, the radicle somewhat prominent; sterile spikelet commonly yellowish at the base and brownish to a greater or less extent from the apex downward, frequently prominent, often persisting tenaciously after the maturity of the grain.

Chief distinguishing characters: Semithick, profusely branched stalk; semicompact head with a commonly shortened axis and without awns; thickened yellowish, brownish, grayish, or mottled ovate-elliptic or elliptic glumes, usually extending beyond the reddish brown elliptic-obovate or elliptic grain.

This variety was introduced from Africa under its African name, Undendebule, by which it was designated for some time, being later called Collier.

Planter (fig. 7).—Stalk medium in length, medium in girth, erect; head obovate ovate, or cylindric, semicompact, medium in size; axis about one-fourth the length of the head or longer, sometimes the entire length; branches of head, especially



FIGURE 7.—A head of Planter sorgho

the upper, often nodding; fertile spikelet ovate-elliptic or elliptic-ovate, awnless; glumes commonly semithickened but varying, acute, yellowish, or entirely or in part brown or nearly black, open 45° or as much as 75° , the first glume more or less bent back at the base in the opening, usually persistently hairy where little thickened; vein sometimes visible from the apex to, or nearly to, the base of the glume, the coarser vein on each side of the first glume sometimes beset with minute bristles above; grain commonly extending to the apices of the glumes, elliptic-obovate, or obovate, the summit obtuse and turned somewhat to the ventral side, yellowish, or entirely or in part reddish brown; germ conforming to the dorsal surface of the grain or straighter longitudinally, the radicle commonly somewhat prominent; sterile spikelet yellowish or sometimes in part brownish, usually quite prominent, persisting tenaciously and often remaining with the glumes of the fertile spikelet after threshing.

Chief distinguishing characters: Medium or thick stalk; semicompact head, with a usually shortened axis and without awns; usually semithickened yellowish or entirely or in part brownish ovate-elliptic glumes, extending about as far as the commonly yellowish elliptic-obovate or obovate grain.

This variety was formerly, and is still sometimes, called Planter's Friend.

McLean (fig. 8).—Stalk tall, rather less than medium in girth, erect; head cylindric or approaching cylindric, open or semicompact, medium or large; primary branches of head commonly straight or nearly straight, somewhat oblique or perpendicular to the axis, the longest branches about one-fourth as long as the head; fertile spikelet elliptic or approaching elliptic, awnless; glumes considerably thickened, commonly acute or approaching acute, usually black and shining, the apex of the first glume frequently yellowish, open 10° or as much as 45° , not much bent back at the base in the opening; veins not commonly visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain more commonly not extending as far as the apices of the glumes, usually elliptic-ovate or elliptic-obovate, somewhat flattened and sometimes transversely wrinkled on the ventral side, the summit obtuse or approaching acute and not turned toward the ventral side, medium brown, medium reddish brown, or entirely or in part dark reddish brown or yellowish; germ curved toward the ventral side, the radicle prominent; sterile spikelet

commonly yellowish at the base and brown to a greater or less extent from the apex downward, frequently prominent, the pedicel becoming fragile and tending to release the spikelet at the maturity of the grain, or retaining it some time after.

Chief distinguishing characters: Slender stalk; open or semicompact cylindrical or nearly cylindrical head without awns; thickened black elliptic or nearly elliptic glumes, usually extending beyond the brownish elliptic-ovate or elliptic-obovate grain.

Colman (fig. 9).—Stalk medium in length, medium in girth, erect, inclining, or reclining; head ovate, obovate, or approaching obovate, sometimes somewhat one-sided, semicompact, medium in size; axis extending the entire length of the head or about two-thirds or three-fourths the length; fertile spikelet commonly elliptic or approaching elliptic, awnless; glumes considerably thickened, acute, reddish brown, the apex sometimes lighter, open 45° or as much as 90° , the first glume commonly bent back at the base in the opening; veins usually not visible below the middle of the glume, the coarser vein on each side of the first glume not beset with minute bristles; grain commonly extending beyond the apices of the glumes, obovate-elliptic or elliptic, the summit obtuse and turned somewhat toward the ventral side, light reddish brown or entirely or in part mediumreddish brown, light orange, or yellowish; germ conforming to the dorsal surface of the grain, the radicle commonly prominent; sterile spikelet yellowish or entirely or in part brownish, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Semithick stalk; semicompact head without awns; thickened reddish brown elliptic or nearly elliptic glumes, not extending as far as the reddish brown or orange obovate-elliptic or elliptic grain. This variety differs from Red Amber principally in the exerted grain.

Folger (fig. 10).—Stalk medium in length, medium in girth, erect; head cylindrical or approaching cylindrical, semicompact, small or medium; branches of head short or medium, mainly ascending; fertile spikelet commonly elliptic, or approaching elliptic, awnless; glumes considerably thickened, acute or approaching acute, black and shining or sometimes lighter at the apex, open 45° or as much as 90° , the first glume somewhat bent back at the base in the opening; veins commonly not visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain commonly extending a little beyond the apices of the glumes, obovate-elliptic or elliptic,



FIGURE 8.—A head of McLean sorgho

usually more convex on the ventral side than on the dorsal side, the summit obtuse and not turned, or turned a little, toward the ventral side, commonly buff brown or sometimes entirely or in part buff; germ conforming to the dorsal surface of the grain or straighter longitudinally, the radicle prominent, and the plumule commonly prominent; sterile spikelet yellowish or in part brownish gray, dark gray, or black, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about maturity of the grain.

Chief distinguishing characters: Semithick stalk; semicompact head without awns; thickened black elliptic or nearly elliptic glumes, not extending quite as far as the buff-brown or buff obovate-elliptic or elliptic grain.



FIGURE 9.—A head of Colman sorgho

This variety is sometimes called Folger's Early or Early Folger.

A variety obtained under the name Fort Scott Colman is similar to or identical with Folger.

Orange (fig. 11).—Stalk medium in length, medium in girth, erect, inclining or reclining; head ovate, oval, or obovate, semicompact, medium in size; axis of head extending the entire length of the head or about one-half or two-thirds the length; fertile spikelet commonly ovate-elliptic or approaching ovate-elliptic, awnless; glumes considerably thickened, usually acute, strongly curved inward on the sides, black and shining or some of the glumes brown, open 45° or sometimes more than 90° , the first glume bent back at the base in the opening; veins commonly not visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain extending beyond the apices of the glumes, elliptic, sometimes somewhat flattened on the ventral side,

the summit approaching acute or obtuse and often turned somewhat toward the ventral side, light reddish brown or entirely or in part medium reddish brown or yellowish, sometimes rotated 90° in the spikelet; germ conforming to the dorsal surface of the grain and commonly curved toward the ventral side at the base, the radicle prominent; sterile spikelet usually yellowish at the base and brown to a greater or lesser extent from the apex downward, frequently prominent, the pedicel becoming fragile and tending to release the spikelet somewhat after the maturity of the grain.

Chief distinguishing characters: Semithick stalk; semicompact head without awns; thickened black or brownish ovate-elliptic glumes, not extending as far as the usually reddish-brown elliptic grain. This variety differs from Folger principally in a thicker and more open head, the ovate-elliptic glumes, the more exerted grain, and the color of the grain.

There are a number of varieties called Orange or Early Orange, varying more or less in appearance. Some of these varieties are

similar to the one above described, differing only in minor details, such as the color of the glumes, the grain, or the sterile spikelet. It is proposed to designate this variety the true Orange and to give other names to the remainder.

The following varieties that are not very commonly grown are similar to Orange in their chief characters and should also be included in the Orange group: Silvertop, Albaugh (formerly called Albaugh Early), Jones (formerly called Farmer Jones), and Texan (formerly called Texas Seeded Ribbon). A variety called Honey Drip (formerly

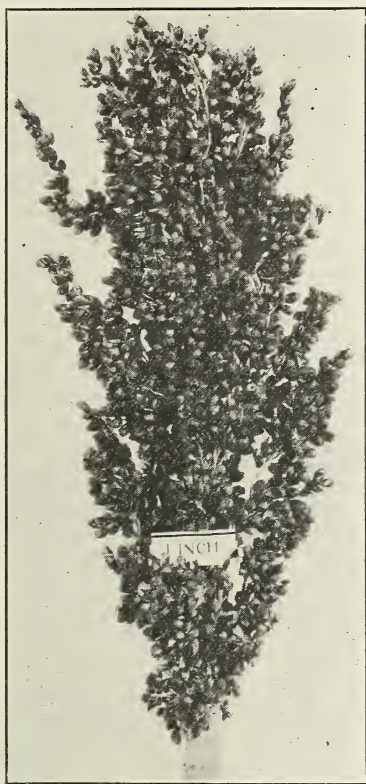


FIGURE 10.—A head of Folger sorgho

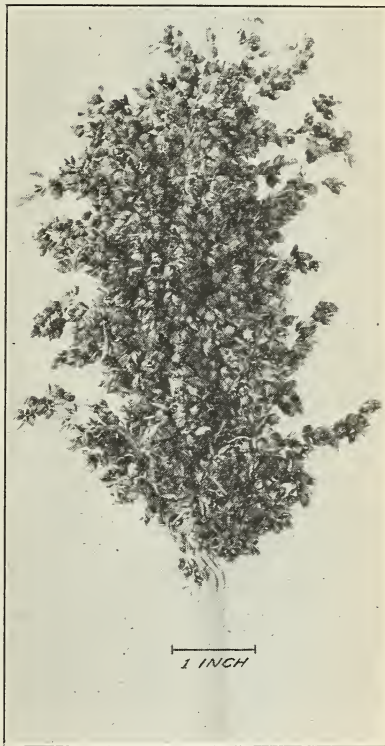


FIGURE 11.—A head of Orange sorgho

called Japanese Honey Drip) is also similar, but the head is more compact, and laterally the grain is commonly elliptic-rhomboid.

Gooseneck.—Stalk tall, large in girth, erect or reclining, reddish brown when mature; peduncle commonly more or less recurved; head frequently inverted, ovate, or occasionally obovate, semicompact, medium or large; fertile spikelet obovate, awned, the awn somewhat short and loosely twisted; glumes considerably thickened, acute or approaching acute, considerably bent or curved inward on the sides, when fully mature black and shining or brownish, the upper one-fourth or one-third of the first glume often yellowish, open 15° or as much as 60° , not bent back at the base in the opening; first glume persistently hairy in the upper one-fourth or one-third; veins commonly not visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain when fully developed commonly extending to the apices of the

glumes or beyond, broadly obovate-elliptic, suborbicular, or broadly elliptic, the summit obtuse and not turned, or turned a little toward the ventral side, medium brown, or entirely or in part medium reddish brown or yellowish; seed coat sometimes wrinkled, especially over the germ; germ straight or nearly straight longitudinally, the radicle prominent and the plumule commonly prominent; sterile spikelet yellowish and brownish or brown, sometimes light at the base and darker from the apex downward, more or less inflated and tending to open, occasionally prominent, the pedicel commonly becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Thick stalk; frequently recurved penduncle; semicompact head having awns; thickened black obovate glumes, extending as far or not as far as the usually brown obovate-elliptic, suborbicular, or elliptic grain.

This variety is sometimes called Texas Seeded Ribbon or Crook-neck.

Indiana Amber (fig. 12).—Stalk medium in length, medium or small in girth, erect; peduncle erect but commonly a little bent; head ovate, oval, or irregularly obovate, semicompact, small or medium; axis extending the entire length of the

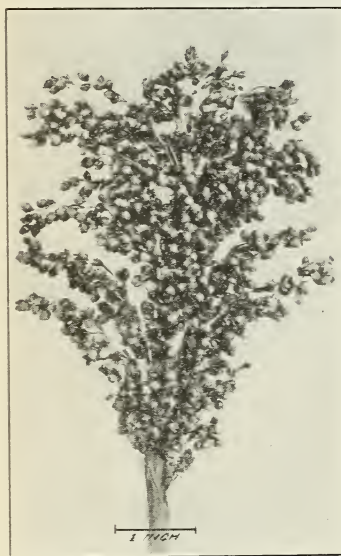


FIGURE 12.—A head of Indiana Amber sorgho

head or about one-third or two-thirds the length; fertile spikelet obovate or sometimes obovate-deltoid or obovate-rhomboid, awned, the awn somewhat short and loosely twisted; glumes considerably thickened, considerably bent or curved inward on the sides, black and shining, open 45° or as much as 90° , not bent back at the base in the opening; first glume obtuse or approaching acute and sometimes toothed at the summit; second glume commonly acute; veins not visible below the middle of the glume, the coarser vein on each side of the first glume beset with black or blackish minute bristles above; grain usually extending beyond the apices of the glumes, dorsally broadly elliptic, broadly obovate-elliptic, or broadly ovate-elliptic, commonly more or less laterally swollen on the ventral side, laterally irregularly elliptic or elliptic-rhomboid, the summit obtuse and not turned, or turned a little toward the ventral side, light brownish yellow, or entirely or in part yellow or buff brown; seed coat usually transversely wrinkled on the ventral side of the grain; germ commonly somewhat curved toward the ventral side, sometimes projecting lower than the endosperm, the radicle prominent; style bases originating in a fold of the seed coat; sterile spikelet yellowish or in part black or dark brown,

more commonly darkest at the base, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Semithick or small stalk; semicompact head having awns; thickened black obovate, obovate-deltoid, or obovate-rhomboid glumes not extending as far as the yellowish elliptic, obovate-elliptic, or ovate-elliptic grain.

A variety in some localities called Ames Amber is apparently identical with Indiana Amber.

Sapling (fig. 13).—Stalk tall, slender, commonly erect; head narrowly cylindric or approaching narrowly cylindric, semicompact or compact, medium or long, slender; branches of head mainly ascending; fertile spikelet ovate-elliptic or elliptic-ovate, awnless; glumes semithickened, acute or approaching acute, black, brownish, or entirely or in part yellowish, sometimes mottled or spotted, open 45° or as much as 75° , the first and second glumes both somewhat bent back at their bases in the opening; veins fine, visible from the summit to below the middle of the glume or sometimes nearly or quite to its base, the coarser vein on each side

of the first glume sometimes beset with a few minute bristles above; grain extending beyond the apices of the glumes, ovate-elliptic or elliptic, the summit obtuse and turned somewhat toward the ventral side, medium brown, medium reddish brown, or sometimes entirely or in part yellowish; germ conforming to the dorsal surface of the grain, the radicle usually prominent; sterile spikelet more commonly light yellow or sometimes in part brownish, finely veined, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Slender stalks; compact, slender, cylindric head without awns; semithickened black, brownish, or yellowish ovate-elliptic or elliptic-ovate glumes, not extending as far as the usually brownish obovate-elliptic or elliptic grain.

This variety is sometimes called Link's Hybrid.

Red X.—Stalk medium in length, medium in girth, erect; head cylindric or approaching cylindric, compact, medium or small; branches of head mainly ascending; fertile spikelet ovate-elliptic or elliptic-ovate, awnless; glumes semithickened, acute or approaching acute, dark reddish brown or sometimes lighter reddish brown, open 45° or as much as 75° , the first and second glumes both somewhat bent back at their bases in the opening; veins fine, visible from the summit to below the middle of the glume, sometimes nearly or quite to its base, the coarser vein on each side of the first glume sometimes beset with a few minute bristles above; grain extending beyond the apices of the glumes, obovate-elliptic or elliptic, the summit obtuse and turned toward the ventral side, orange brown, light orange, or entirely or in part medium reddish brown or yellowish; germ conforming to the dorsal surface of the grain, the radicle commonly prominent; sterile spikelet usually light yellow, finely veined, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Semithick stalk; compact cylindric head without awns; semithickened reddish brown ovate-elliptic or elliptic-ovate glumes, not extending as far as the orange-brown, brownish, or yellowish obovate-elliptic or elliptic grain.

This variety is sometimes confused with *Sugar Drip* (p. 20), the seed sometimes being sold under that name.

Sumac (fig. 14).—Stalk medium in length, medium in girth, erect or sometimes reclining; head cylindric, compact, small (5 to 8 inches long, $1\frac{1}{2}$ to $3\frac{1}{2}$ inches broad); branches of head short, appressed; fertile spikelet commonly elliptic or approaching elliptic, awnless; glumes considerably thickened, obtuse or sometimes approaching acute, dark brown or nearly black at the base or farther upward and dull yellow above or entirely dull yellow, open 45° or as much as 90° ; first glume somewhat bent back at the base in the opening, more persistently hairy than the second glume; second glume commonly somewhat more thickened and darkly colored; veins sometimes visible from the summit to three-fourths or four-fifths the length to the base, the coarser vein on each side of the first glume

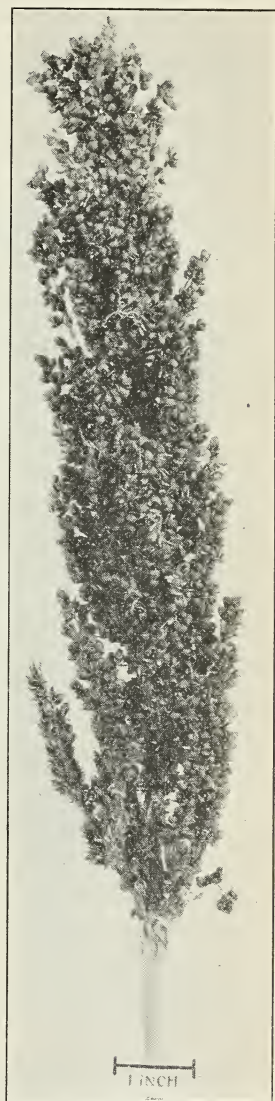


FIGURE 13.—A head of Sapling sorgho

beset with minute bristles; grain extending well beyond the apices of the glumes, broadly obovate or broadly elliptic-obovate, the summit globose and turned somewhat toward the ventral side, commonly yellowish or orange brown below and dark reddish brown above where exposed; germ curved somewhat toward the ventral side, sometimes jutting outward from the endosperm at the base and sometimes extending lower, the radicle sometimes prominent; sterile spikelet yellowish and brown, frequently light at the base and darker to a greater or less extent from the apex downward, small, not prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Semithick stalk; compact cylindric head without awns; thickened yellowish, or entirely or in part brownish, elliptic or nearly elliptic glumes, not extending as far as the reddish brown or in part yellowish obovate or elliptic-obovate grain. This variety differs from Sugar Drip principally in a more compact head, the obovate or elliptic-obovate grain, and the color of the glumes and grain.

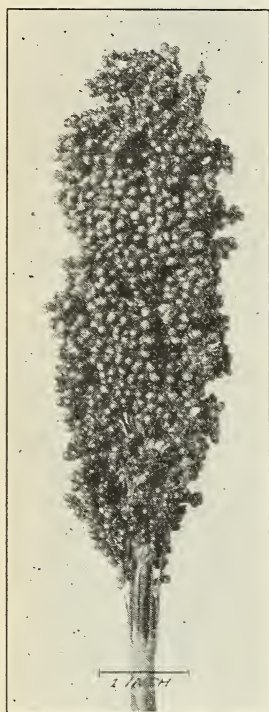


FIGURE 14.—A head of Sumac sorgho

This variety is sometimes called Club Top or Red Top.

Sugar Drip (fig. 15).—Stalk medium in length, medium in girth, commonly erect; head cylindric or approaching cylindric, compact, medium or small; branches of head mainly ascending; fertile spikelet ovate-elliptic or elliptic-ovate, awnless; glumes considerably thickened, acute, black or some of the glumes brownish, the apex frequently dull yellow, open 45° or as much as 75° , the first glume bent back at the base in the opening; veins coarse, not commonly visible below the middle of the glume, the coarser vein on each side of the first glume beset with minute bristles above; grain extending beyond the apices of the glumes, obovate-elliptic or elliptic, the summit obtuse and turned toward the ventral side, medium brown, medium reddish brown, or sometimes entirely or in part yellowish; germ conforming to the dorsal surface of the grain, the radicle commonly prominent; sterile spikelet light yellow or sometimes in part brownish, strongly veined, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Semithick stalk; compact cylindric head without awns; thickened black or brownish ovate-elliptic or elliptic glumes, not extending as far as the usually brownish obovate-elliptic or elliptic grain. This variety differs from Red X principally in the more thickened glumes and in their color.

There are varieties or strains similar to Sugar Drip, differing in that the glumes are brown or reddish brown. These also are sometimes called Sugar Drip, or they are given a locally known name.

White African (fig. 16).—Stalk medium or tall, medium or large in girth, erect; head cylindric or obconical, compact, medium or small; axis of head less than one-fourth the length of the head, or longer; branches of head coarse, mainly ascending; fertile spikelet obovate-elliptic or elliptic, awnless; glumes considerably thickened, acute, approaching acute, or sometimes obtuse, black or sometimes dark brown, except occasionally lighter at the apex, open 30° or as much as 60° , not bent back at their bases in the opening; veins not visible below the middle of the glume, the coarser vein on each side of the first glume sometimes beset with minute bristles above; grain extending to or beyond the apices of the glume, obovate-elliptic or elliptic, the summit obtuse and not turned or turned a little toward the ventral side, white, or sometimes with brownish spots or blotches; germ conforming to the dorsal surface of the grain, the radicle commonly somewhat

prominent; sterile spikelet light yellow, nearly white, or sometimes with grayish or brownish spots or blotches, occasionally prominent, the pedicel becoming fragile and tending to release the spikelet at about the maturity of the grain.

Chief distinguishing characters: Medium or thick stalk; compact head with a usually shortened axis and without awns; thickened black or dark-brown obovate-elliptic or elliptic glumes, extending as far or not as far as the white obovate-elliptic or elliptic grain.

From descriptions and illustrations published earlier, this variety appears to be the one at one time called White Mammoth.

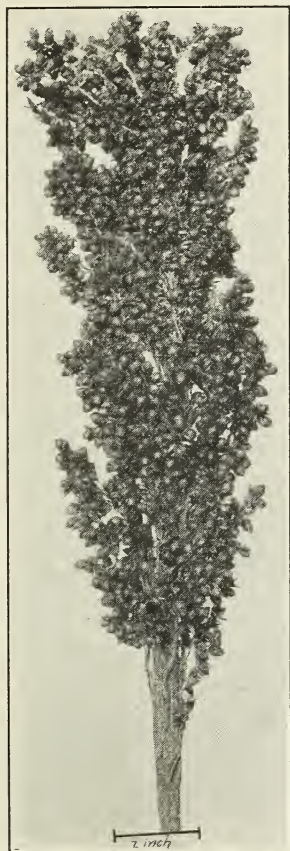


FIGURE 15.—A head of Sugar Drips sorgo

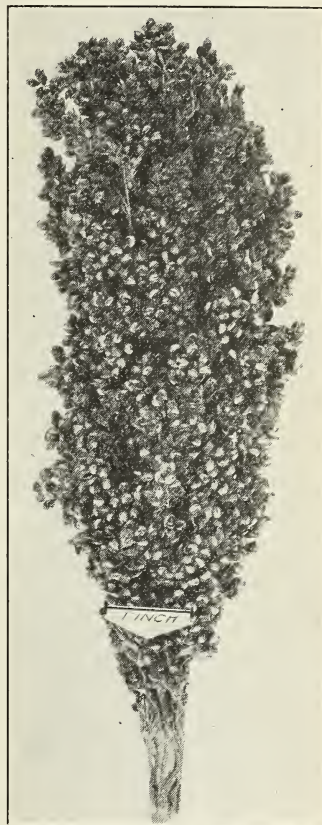


FIGURE 16.—A head of White African sorgo

SUMMARY

Growers experience great difficulty in obtaining seed of true-to-name sorgo varieties because of the great confusion that exists with regard to varietal names. Standardization of varietal names and adequate descriptions of the leading varieties are recognized as necessary steps in sorgo improvement. Because of the lack, at present, of sources of seed it is advised that, to procure seed for planting, growers select seed heads true to type in the best available fields.

To make usable the descriptions of leading sorgo varieties, the structures of the head and spikelets of sorgo are described, and the technical terms used in the descriptions are defined.

Certain varieties show close relationships in respect to the form and structure of the head or its parts, and these relationships are followed in the grouping of varieties.

Descriptions of 16 of the better known varieties are given under the name believed to be most acceptable. Other names commonly used for these varieties are listed.

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May 28, 1929

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